

## KB STARTING MOTORS

Workshop: EL  
12.1994

Thermoplastic-encapsulated terminals      ST 0438 En

It should be possible to operate KB starting motors without problem whatever the installation position. For this purpose, the following improved quality feature was introduced as of FD 461 (1.94):

The connecting bar term. 30 and the terminal stud term. 50 are insulated by way of thermoplastic encapsulation on the inside of the starting motors.

To guarantee operation irrespective of installation position on starting motors prior to FD 461 (1.94) as well, the old, non-insulated version of terminals 30 and 50 must be converted to the new design with thermoplastic encapsulation.

When converting starting motors prior to FD 461, a distinction is to be made between two situations:

1. On starting motors with M 12 thread at connection term. 30 conversion is effected with parts set term. 30, 31 (2 007 011 069), parts set term. 50 (2 007 011 070) and new connecting bar term. 30.

2. Starting motors with M 10 thread at connection term. 30 additionally require a new commutator end shield for conversion purposes to permit use of the new insulated connecting bar.

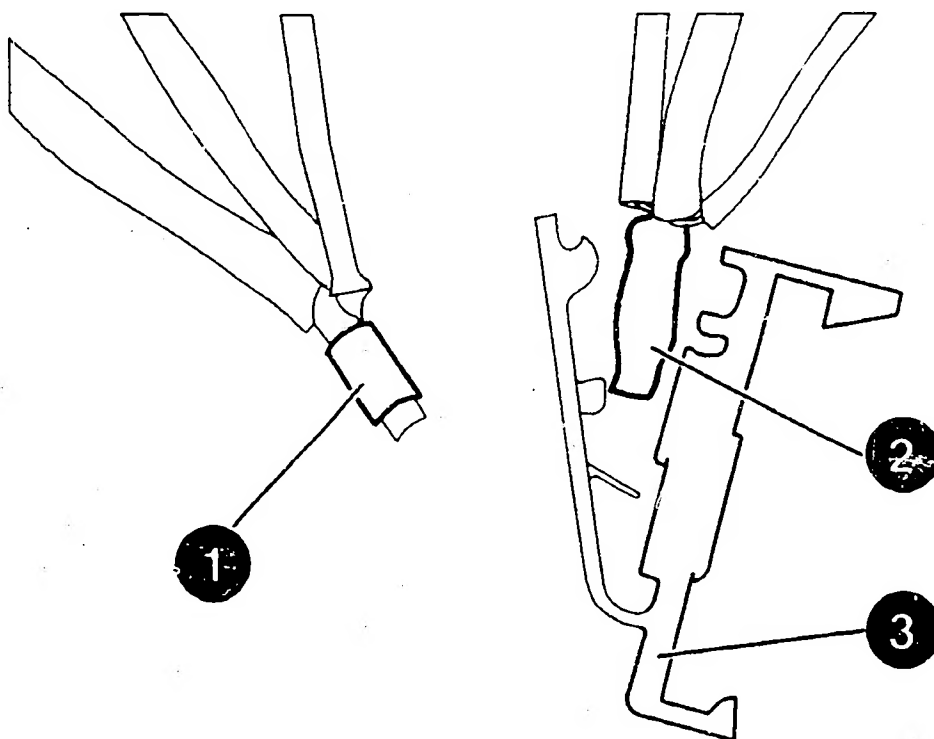
Old, non-insulated connecting parts are no longer available.

When converting old starting motors to new insulated version and when repairing new insulated design, attention is to be paid to the following.

Information on conversion/repair of new insulated version:

When installing insulated term. 50, electrical connection to control relay and to holding winding from solenoid switch must be re-established as follows:

- \* Bare approx. 10 mm of cable.
- \* Insert all 3 cables in end splice (1), press together slightly and soft solder (see fig., left).
- \* Pull shrink-down tubing (2) over end splice (cable ends must not protrude out of tubing, 3 = retainer).

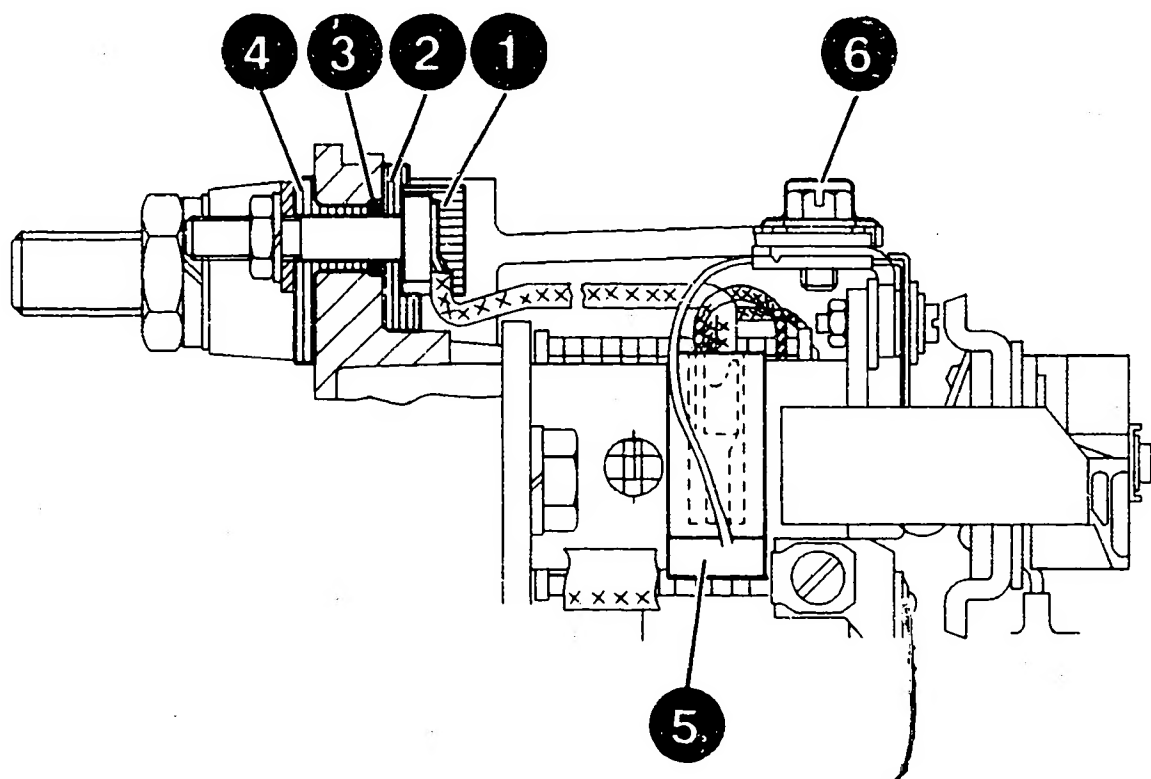


KMS00020

- \* Fit N E W retainer (disposable item) at control relay (lug of retainer must be positioned in groove at solenoid bracket of control relay).
- \* Insert insulated sleeve into retainer at control relay as far as it will go and press retainer together.

Fig. shows new insulated version:

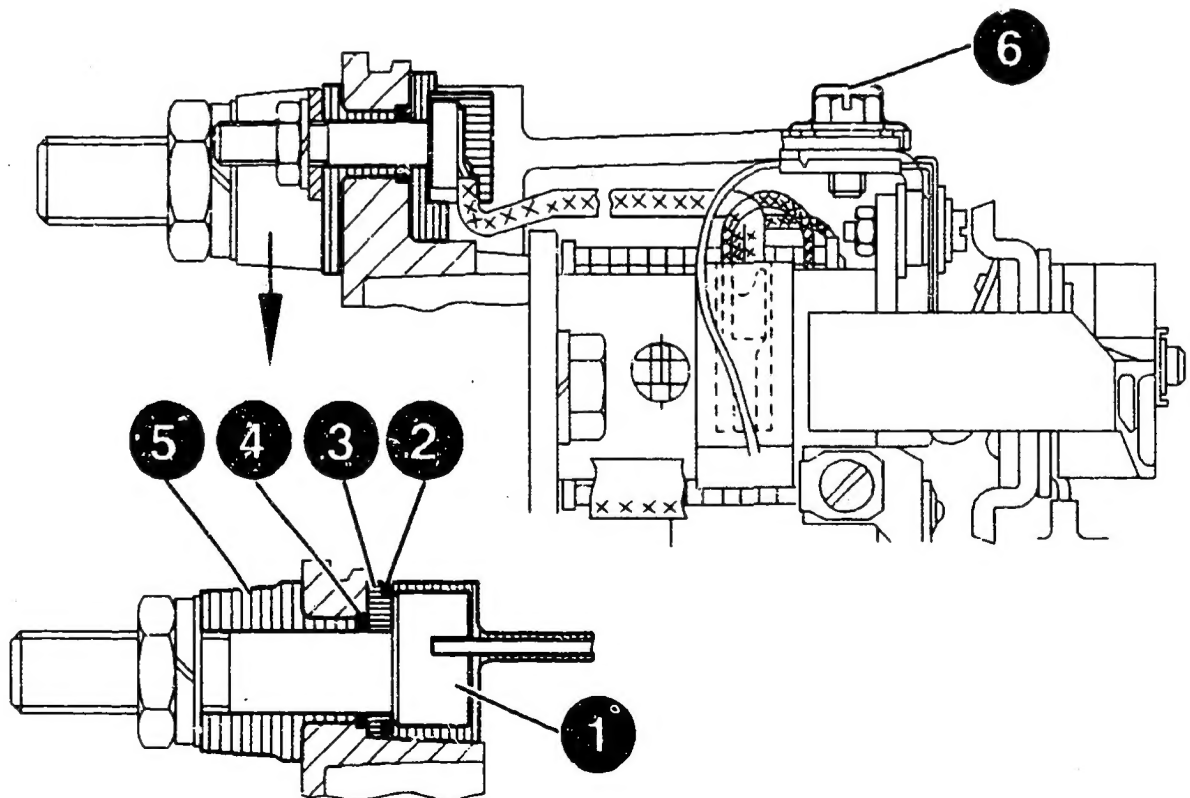
- 1 = Insulated terminal stud term. 50
- 2 = Insulating part term. 30,  
term. 50 inner
- 3 = O-ring
- 4 = Insulating part term. 30,  
term. 31 and term. 50 outer
- 5 = Retainer (disposable item)
- 6 = Insulating cap term. 30



The new insulated version of term. 30 is shown at the bottom of the fig.

- 1 = Insulated connecting bar term. 30
- 2 = Seal term. 30 (red)
- 3 = Insulating part term. 30, term. 50 inner
- 4 = O-ring
- 5 = Insulating part term. 30, term. 31 and term. 50 outer
- 6 = Insulating cap term. 30

Following installation of new connecting bar term. 30 new insulating cap (6) must be fitted on hexagon bolt (term. 30).

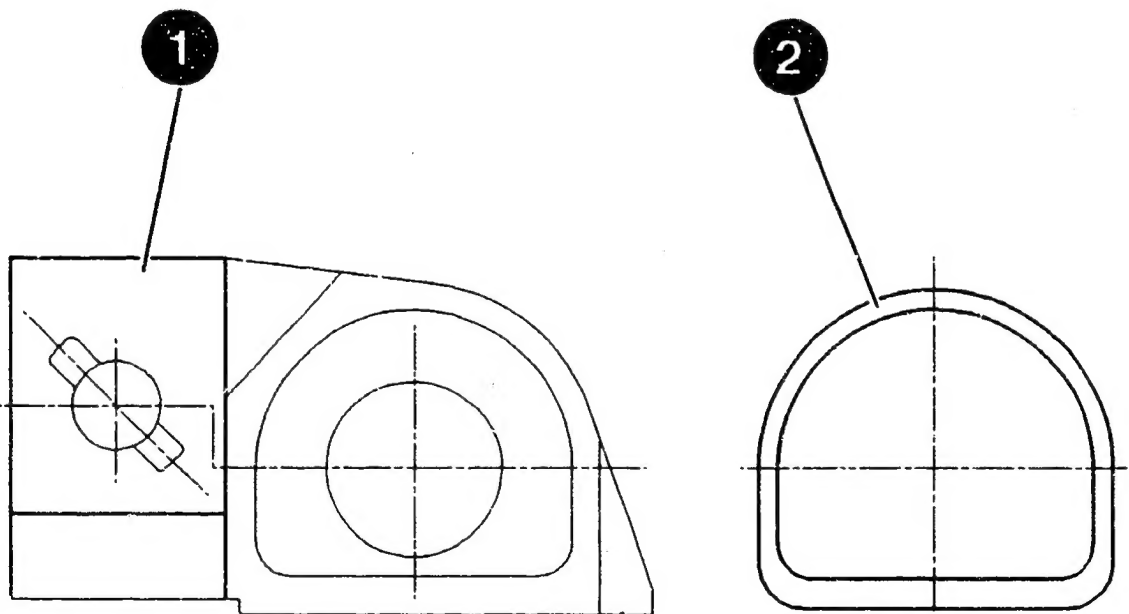


In the conversion phase as of FD 461, term. 30 was sealed on the inside by way of silicon encapsulation between connecting bar and inner insulating part.

When repairing such starting motors, use is to be made of the new insulating parts illustrated (in parts set term. 30, term. 31).

- 1 = Insulating part term. 30,  
term. 50 inner
- 2 = Seal term. 30 (red)

KMS00025



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QUICK  
LOCATION OF NEW  
SERVICE INFO  
ON MICROCARDS

Vehicle: PKW  
12.1994  
ST 0425 En

Service Info has been exclusively published on microcards since mid-1991. There is no longer a hard copy.

We are often asked where the latest Service Info is to be found, and on which microcards.

The latest Service Info always comes at the end of a given microcard so as to make for a rapid overview of the most important new features as required.

Microcards featuring Service Info are marked with an \* on the record list.

Listed in the following for your reference are the current Service Info microcards which will be distributed as and where necessary:



**Assembly shops**

1. FZG-001      Information from and for  
Bosch Service Stations
2. FZD-049      Passenger and commercial-  
vehicle info (Diesel only)
3. KFZ-017      Info concerning both pass-  
enger and commercial veh-  
icles (not brakes and  
Diesel)
4. PKB-050      Brake-system info incl.  
ABS for passenger and  
commercial vehicles
5. NKW-021      Info exclusively for  
commercial vehicles  
(incl. Diesel)

**Assembly shops**

6. PKW- 184      Info exclusively for  
passenger vehicles  
(not brakes and Diesel)
7. PKW-5038      Info exclusively for  
passenger vehicles with  
mixed and non-Bosch  
systems (not brakes and  
Diesel)

**Repair shops**

- 8. W-001/027 EL workshop info
- 9. W-400/051 EP workshop info
- 10. W-480/005 NB workshop info

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ELECTRICAL  
CONNECTIONS

Motor vehicle:  
PKW,NKW,FZD,PKB  
Workshop: EL, EP

ASSESSMENT OF FUNCTION

06.1996  
SI 0516 En

Electrical connections between components and wiring harness are exposed to numerous impacts:

Fluctuations in temperature, humidity or atmospheric pressure, contact with water, fuel or oil and deposits (dust, dirt and/or salt).

Mechanical stresses such as tension, compression, vibration and acceleration also occur.

This leads to faults with electrical connections, particularly on older vehicles.

## 1. ASSESSMENT OF OVERALL CONNECTION

Connector attached.

- Cable too short or damaged
- Connection severely fouled
- Seat loose (with/without lock)
- No spring clip on plug
- Plug housing damaged
- Protective cap leaking

Disconnected component plug

- Sealing edge damaged
- Plug pins damaged  
(see Figs. in Section 3)
- Parts of plug corroded
- Foreign matter on plug

Disconnected wiring-harness plug

- End sealing ring deformed or missing
- Non-engaged contacts damaged/pushed back or no contact

## 2. ASSESSMENT OF PLUGS

The two Figs. show the frequently used two-pin blade terminals of many Bosch components.

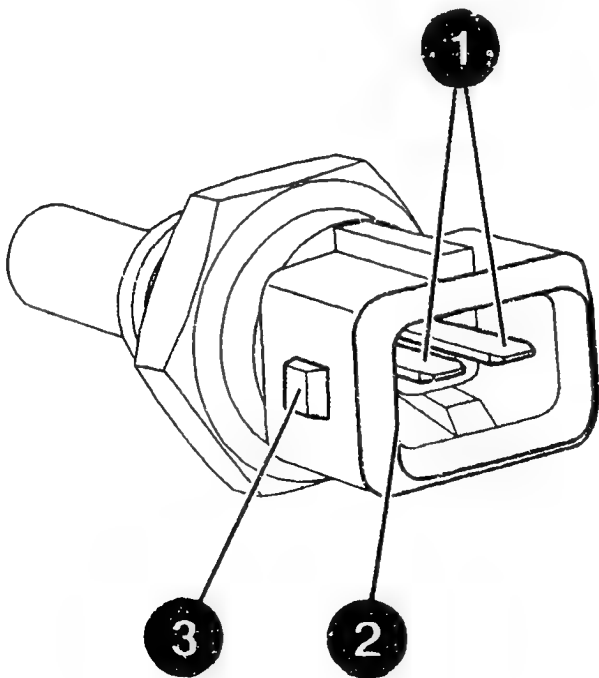
Other multi-pin plugs are usually of similar design.

Assessment of component plug

Note the following (see Fig.):

- Plug pins (1)
- End sealing edge (2)
- Side locking lugs (3)  
for spring clip

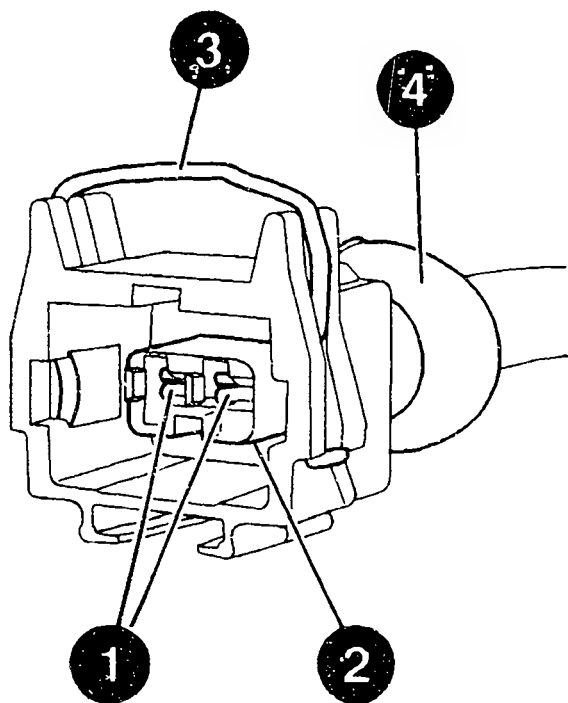
KKE01062



**Assessment of wiring-harness plug**  
**Note the following (see Fig.):**

- Flat spring contacts (1)
- End sealing ring (2)
- Spring clip (3)
- Protective cap (4)

KKE01063



### 3. ASSESSMENT OF PLUG-IN CONTACTS

The following Figs. illustrate examples for the assessment of serviceable and damaged plug pins.

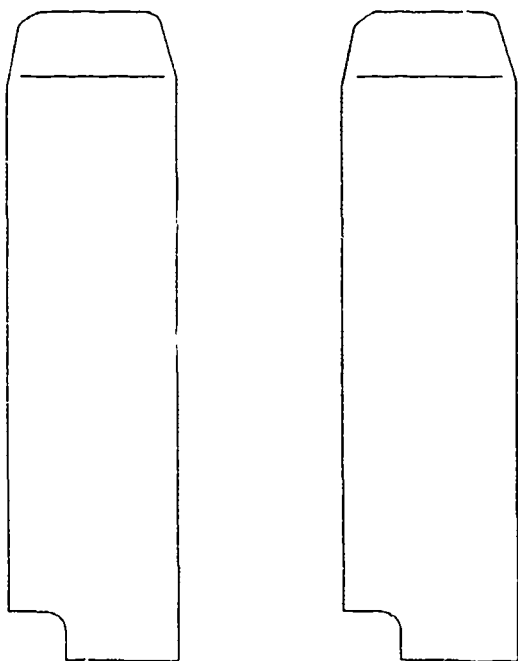
NO CONTACT MARKS (new)  
(see Fig.).

#### Findings:

- No contact marks
- No appreciable dimensional or geometric errors on housing or plug section
- Plug pins not at an angle

Assessment:  
Plug pins OK.

KKE01064



**NORMAL CONTACT MARKS**  
(see Fig.)

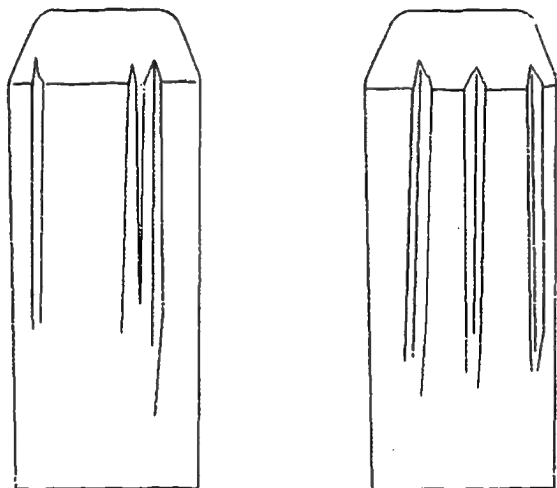
**Findings:**

- Contact marks in center of plug pin
- Contact overlap (groove length on contact surface) more than 1 mm

**Assessment:**

Plug pins OK.

KKE01065





**MECHANICAL CONTACT MARKS**  
(see Fig.)

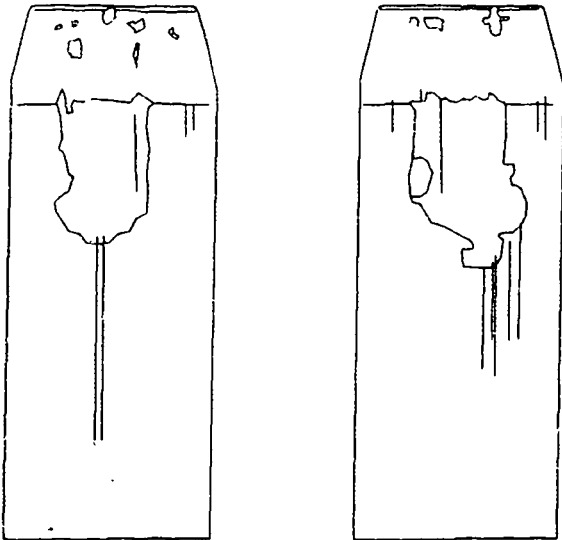
**Findings:**

- Contact point damaged  
(scratched or scored)
- Pins bent (bent plugs due to  
inexpert handling of measurement  
prods)
- Partial flaking of tinned surface  
(indication of wear)

**Assessment:**

Plug pins not OK.

KKE01066



**OXIDIZED CONTACT MARKS**  
(see Fig.)

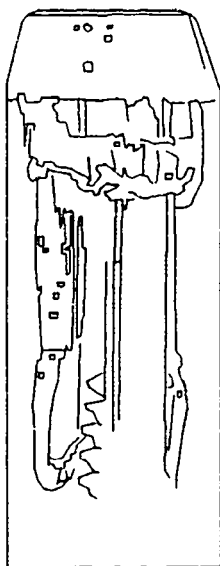
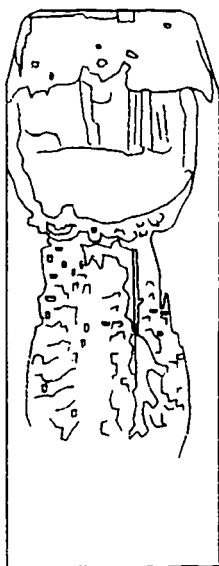
**Findings:**

- Severe oxidization of contact point, oxidation residue (e.g. tin oxide)
- Friction corrosion
- Surface finish worn down to substrate

**Assessment:**

**Plug pins not OK.**

KKE01067



**THERMAL CONTACT MARKS**  
(see Fig.)

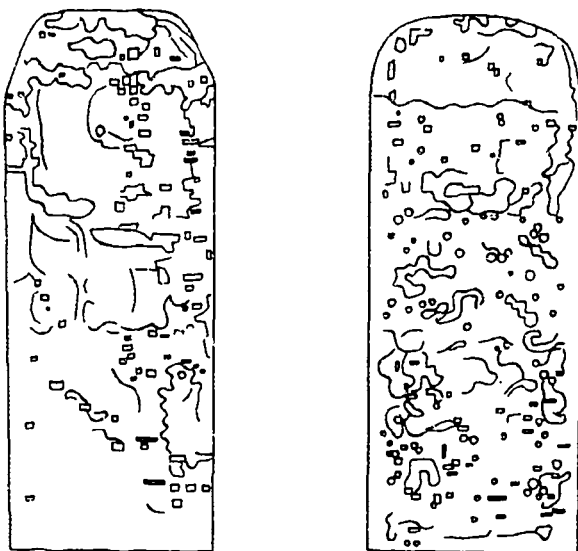
**Findings:**

- Contact scorched
- Contact surface discolored due to overheating

**Assessment:**

Plug pins not OK.

KKE01068



**DEPOSITS**  
(see Fig.)

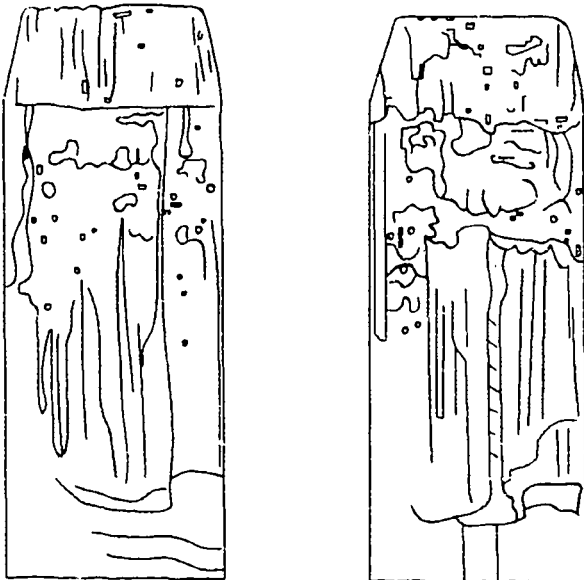
**Findings:**

- Deposits and condensates on plug pins
- Residue on plug pins
- Plug pins covered with lacquer for example
- Contact point partially corroded
- Loose particles (dust, dirt etc.) on plug or contact

**Assessment:**

Plug pins not OK, leaky connection.

KKE01069



#### 4. IMPORTANT

- \* Any attempt to eliminate contact problems with a brush or treatment with contact spray does not generally meet with lasting success. It is better to renew the contacts straight away.
- \* Component and wiring-harness plug must have the same surface finish: Either both tinned or both gold-plated.

\* If the component plug is to be renewed, then the wiring-harness plug must be as well; it is normally damaged anyway and problems could soon be encountered again if use were to be made of a new connector with an old socket.

\* A bright lamp and a magnifying glass are needed for exact assessment of a plug pin.

**Note:**

The black/white plug illustrations shown here are not of outstanding quality. A better impression is given by the color chart "Bosch-Tips" 4 400 001 018.

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JETRONIC AND  
MOTRONIC  
  
LAMBDA SENSORS

Motor vehicle: PKW  
and Workshop: EL  
06.1996  
SI 0278 En

Type overview

Testing

Possible problems with sensor function.  
Installation of non-approved sensors.  
Vehicle retrofitting for operation  
with leaded fuel.

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**TYPE OVERVIEW, NON-HEATED LAMBDA  
SENSORS**

**Designation: LS 4**

**Features: Lambda = 1 control, 1-pole  
Standard protective coating**

**Fuel : unleaded**

**Designation: LS 4 t**

**Features: as LS 4, however  
submersible  
For extreme water impacting  
at installation location.  
Recognizable from fine  
weld and protection sleeve  
next to hexagon.**

Designation: LS 4 m

Features: as LS 4, however 2-pole in view of ground cable for sensor signal.

For special requirements as regards signal ground.

Designation: LS 14

Features: as LS 4, however special protective coating for greater resistance to silicon and lead

Designation: LS 21

Features: as LS 4, however new double protective coating for greater resistance to silicon and lead. Also shorter response times.

#### TYPE OVERVIEW, HEATED LAMBDA SENSORS

Designation: LSH 6

Features: Lambda = 1 control  
Standard protective layer.

Fuel: Unleaded

Designation: LSH 15

Features: Lambda = 1 control  
Sintered-in protective layer

Fuel: Unleaded

Designation: LSH 22

Features: Lambda = 1 control  
Sintered-in protective layer  
Floating

Fuel: Unleaded



Designation: LSH 24

Features: Lambda = 1 control  
Double protect. layer and in-  
creased resist. to silicon.

Fuel: Unleaded

Designation: LSH 25

Features: Lambda = 1 control  
Double protect. layer and in-  
creased resist. to silicon.  
Floating

Fuel: Unleaded

Designation: LSH 23

Features: Lambda = 1 control  
Resistant to lead

Fuel: Leaded

Designation: LSH 64

Features: As LSH 6, however  
floating

Fuel: Unleaded

Designation: LSM 11

Features: Lambda = 1-control and  
lean/rich assessment in  
range Lambda  
1.65...0.75.  
Wide-band Lambda curve  
Lead-resistant

Fuel: Leaded

**Designation:** LSF 4

**Design:** Further developed finger probe with slim, wafer-like sensor ceramic.

This contains the measurement cell with the reference air duct and heater.

**Function:** Corresponds to familiar finger probe with step curve.

**Features:** Lambda = 1-control  
Floating, low heating power, short ON time, smaller and lighter, stable control characteristic.

**Fuel:** Unleaded

## VERSIONS

**Standard:** Heater 12 W  
Conduit with 3 slots.  
3 electr. connections with ground via probe housing.  
4 electr. connections with floating design or design with additional ground lead.  
Heater 5 W with LSF 4 probe.

**Designation p:** Heater 18 W  
Faster activation of Lambda control.  
Heating must be switched off as of 800 Grad C.

Designation h:

Conduit made of Inconel. Exhaust-gas temp. up to 1000 Grad C for brief periods.

Designation l:

Conduit, 1 hole and 4 flaps. Better protection against deposits. Damping of Lambda voltage signal.

Designation m:

Additional ground lead for probe signal.

Designation t:

Immersion-proof for extreme exposure to water with under-floor position. Distinguished by fine weld around protective sleeve next to hexagon.

## ELECTRICAL CONNECTIONS

Lead color	Function
Black	Probe signal, pos.
Grey/housing	Probe signal, neg.
White, 2 leads	Heating, pos./neg.

## INSTALLATION INSTRUCTIONS

- \* Apply small quantity of assembly paste VS 14016 FI to thread only, 120 g tin, part no. 5 964 080 112.
- \* Tightening torque: 50...60 Nm
- \* Connector, particularly that of immersion-proof probe, is always to be kept clean. "Breather hole" must never become clogged as otherwise probe will not function properly. Make sure that neither contact spray, oil, grease, fuel, underseal nor road dirt can get onto or into cable at connector.

## TESTING

The lambda sensor is to be tested with the engine running and at operating temperature using the lambda closed-loop control tester ETT 018.10, part no. 0 684 101 810.

Connection to the vehicle is described in the operating instructions for the tester.

Any lambda sensor can be connected up by way of a vehicle-specific multiple adapter lead. The part numbers for the adapter leads are given in the Service Info "Lambda closed-loop control tester". Refer to microcard SIS KFZ-00. motor vehicle:pass. car/comm. veh.

## TEST SPECIFICATIONS

Probe heating (white leads)

With engine stopped, LSH		LSF
* Resistance (PTC): 1...15		5...30 Ohm

With engine running

* Supply voltage:	8...15		8...15 V
* Heating current:	> 0.5		< 0.5 A

Probe signal (Pcs. = black lead,  
ground = housing/grey lead).

\* Resistance at 350 Grad C: < 8 kOhm

\* Probe voltage at

Lambda = 0.97:	> 650		630...840mV
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Lambda = 1.10:	-100...80		15... 75mV
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\* Response time for voltage step change  
300->600 /600->300 mV: <500 | < 100 ms

### Notes

Functional control can be assumed in the fuel injection system if the measured actual values are within the test-specification tolerance.

In view of the fact that the exhaust-gas values of a vehicle are also highly dependent on the other system components (engine, catalytic converter, installation position and closed-loop control), these values do not make it possible to draw reliable conclusions as to the emission behaviour.

## Test instructions

Further important aspects as regards trouble-shooting on lambda closed-loop control.

- \* Check control-unit sensor input.

S e p a r a t e sensor plug connection.

Measure lambda countervoltage (from control unit) at idle with digital multimeter : 400...500 mV.

- \* Lambda sensors with no gray lead are provided with engine ground by way of exhaust manifold and exhaust pipe. Loose connections or increasing exhaust-system age can result in driving problems on account of the ground offset becoming larger.
- \* Even minor leaks in the exhaust system between engine and lambda sensor cause rough engine running.

## POSSIBLE PROBLEMS WITH SENSOR FUNCTION

### External influences:

- \* Damage caused by flying stones.
- \* Damage to connecting leads at kinked areas/abraded areas as well as damage caused by the heat of the exhaust pipe.  
Applies only to "non-submersible" sensors:
- \* Short-term electrical malfunction caused by ingress of splashwater at "breather hole". This problem generally disappears after engine has been running for a few minutes as a result of evaporation.
- \* The sensor must be covered if under-body sealant is applied. Clogging of the "breather hole" results in permanent damage and rough engine running.

### Internal influences:

The functioning of the sensor is impaired by various types of "foreign matter" in the exhaust gas. This can result in total failure depending on degree of contamination and type of sensor.

#### "Foreign matter":

- \* Coolant containing antifreeze
- \* Engine oils, in particular synthetic oils
- \* Non-combustible additives in fuel
- \* Leaded fuel
- \* Silicon compounds in fuel tank or in fuel lines.

Normal amounts of coolant and engine oil are not harmful.

Thermo-shock fractures of the active ceramic can be caused by exhaust-gas condensate.

## INSTALLATION OF NON-AUTHORISED PROBES

Instead of the standard probe fitted by the vehicle manufacturer, it is often desirable or necessary to fit a different one with more extensive features.

### Examples of desired alternative probes

Standard probe	Alternative probe ?
Unheated	Heated
Standard	Immersion-proof
Standard	Lead-resistant
Standard	Silicon-resistant
LSH	LSM, LSF

### Conversion is not generally permitted!

Lambda sensors are approved by the vehicle manufacturer for individual vehicles.

Officially, the vehicle is not licensed if sensors are fitted which differ from the type approval.

If problems are encountered in individual cases with the series sensor, for example, if water has ingressed or in the case of temporary operation with leaded fuel, customers are to be referred to the vehicle manufacturer's representative.

For example, lead-resistant sensors have been released for various export models.



## VEHICLE RETROFITTING

The instructions given by the vehicle manufacturer are always to be followed if a vehicle with regulated catalytic converter is to be retrofitted for operation with leaded fuel.

Catalytic converter and lambda sensor are normally removed to stop them becoming clogged by lead compounds. An appropriate exhaust pipe is fitted in place of the catalytic converter and usually a plug instead of the lambda sensor. The open wiring-harness plug remains unused and is not to be connected either to positive or negative. The engine runs on an open loop-controlled mixture.

Any further measures which may be required such as recoding or circuit changes are always to be performed on the basis of the instructions given by the vehicle manufacturer.

**Note:**

If vehicles feature self-diagnosis, then this is likewise affected by removal of the lambda sensor.

**I M P O R T A N T**

Following retrofitting, it is to be expressly pointed out to customers that the log book is to be altered accordingly by the licensing authorities. If this alteration is not made, the vehicle is no longer licensed and drivers may face charges of tax evasion.

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# N3 ALTERNATOR

Workshop: EL  
06.1996  
SI 0525 En

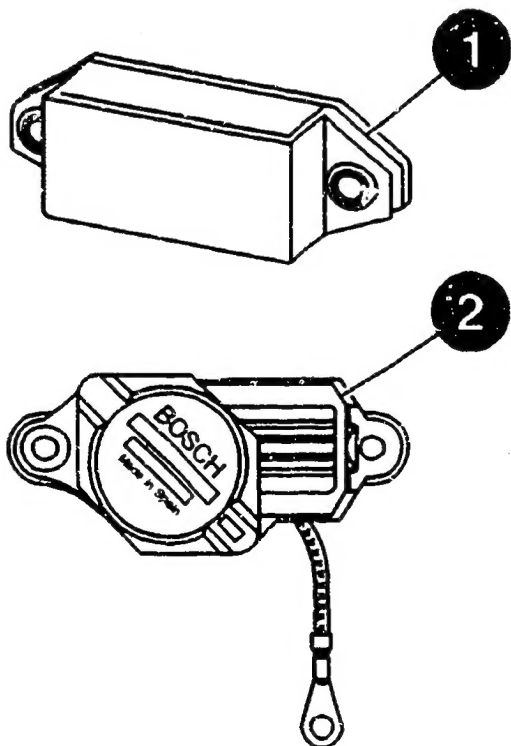
Switch to new EL regulator

For N3 alternators (0 122 469 00.) the EE regulator 0 192 053 010 was replaced as of 03.95 (FD 563) by the new EL regulator 1 197 311 318.

The new EL regulator differs from the old EE regulator in that it features an additional ground connection (D-).

- 1 = EE regulator 0 192 053 010
- 2 = EL regulator 1 197 311 318

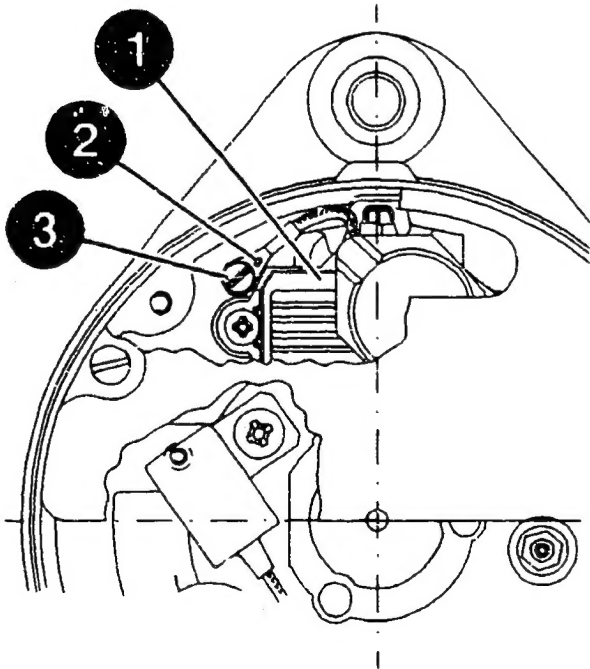
KME00322



The additional ground connection (D-) of the EL regulator must be attached to ground with an M4 stud.

- 1 = EL regulator
- 2 = Ground connection with terminal
- 3 = Stud M4

KME00323



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